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OUR GUNS

WHENEVER attempts are made to manage scientific matters by means of committees failure is sure to result. Some of our Continental friends, the French especially, are fond of working in pairs, and excellent results have been arrived at by such means, but the method does not appear suitable to the English intellect, hence all our great achievements in science have been attained by single individuals. As soon as a committee gets to work, darkness seems to fall over the intellects of its members, and not only are the most absurd blunders perpetrated, and errors of judgment committed, but they are persevered in long after outsiders have detected and exposed them. We need only mention the Longridge wire-gun and the Moncreiff carriage as instances of the defective judgment which kept back the introduction of these useful and original inventions for some thirty years. But the blindness of the Ordnance Committee, or of the Unknown Being who is responsible for our guns, is still more curious and distressing with reference to the strains which guns must be constructed to withstand. We look in vain for any information on this head from the recent reports of committees or from the lectures of their inspired representatives, while such information as we have reveals the fact that, at the time when our new breech-loaders were designed, the knowledge of pressures which the Unknown Designers had was absolutely erroneous, and that the errors were of so elementary a character that it requires no special knowledge of the subject to detect them. If the indicator-diagrams of a steam-engine, and a statement of the work performed by it, were laid before, at any rate, the two civil members of the Ordnance Committee, with a request that the pressures in the cylinder should be investigated with a view to ascertaining whether they were correct, these gentlemen would, at once, compare the indicated power with the work done, and if the former were less than the latter they would, without hesitation, declare that the pressures said to have prevailed in the cylinder were too low. Now, attached to the official drawing of the first 10-inch breech-loading gun was a pressure-curve purporting to represent one-fourth the bursting pressure when firing a projectile of 500 lbs. weight, and imparting to it a muzzle velocity of 2100 feet per second. The mean pressure, measured from this curve, is 8·8 tons per square inch, the travel of the shot in the bore is 22 feet, hence the work done by the powder would be 15,205 foot-tons. The muzzle energy of the shot is a little more, namely, 15,284 foot-tons. But besides the energy communicated to the shot, the 300 lbs. weight of powder gases have to be set in motion, the friction of the gas checks has to be overcome, rotation has to be imparted to the shot, the atmosphere has to be displaced, and the aggregate of this work can be shown to amount to at least one-third of that required to drive out the shot, a fact which the pressures recorded in the experiments made with the *Thunderer* gun clearly proved. Colonel Maitland, in his lecture on our new guns at the United Service Institution in June 1884, rightly pointed out that the area bounded by the pressure-curve represented the work done in the bore; how is it, then, that it never occurred to any one on the Ordnance Committee to compare the work done with the effect produced? Such a comparison would have shown 20,400 foot-tons of work done by an indicator-diagram measuring only 15,205 foot-tons! The check pointed out should have been applied as a matter of common prudence, because it is notorious that then, as now, our direct knowledge of the pressure of powder gases in the bores of guns was very limited.

We are aware that it has been explained that the pressure-curve we have been discussing does not represent powder-pressures, but pressures one-fourth of those which would burst the gun; but such an explanation does not mend matters, for it reduces the factor of safety of the gun—already assumed at the dangerously low limit of four—to three, which no one, surely, would contend to be sufficient!

We are obliged to revert to the question, Why has not an actual pressure-curve been made public, and why did not the *Collingwood* Committee commence their report by showing that the 12-inch 43-ton gun was designed of sufficient strength? The answer, we are afraid, is that our gun-builders do not know what pressures they have to contend against, that our guns are being made by rule of thumb; in fact, their proportions are slowly arrived at by the costly method of trial and error.

Again, Colonel Maitland, in his lecture, gives a diagram showing, graphically, the pressure resulting from firing quick-burning, medium, and slow-burning powders. We must assume, the curves being given for the purpose of comparison, that they represent the effects of the same weights of powder burned under exactly similar conditions; therefore the areas of the figures bounded by the curves, as Colonel Maitland tells us, represent the work done in the gun, and measuring the areas of each curve up to only 14 calibres' length of bore we find that the slow-burning powder does more than twice the work of the medium-burning, and two and a half times that of the quick-burning powder! Surely Colonel Maitland would not wish us to draw such conclusions; and yet they are necessarily deduced from a diagram which must have represented the views of the Ordnance Committee only two years ago, and after Capt. Noble had shown, in his admirable lecture on "The Heat-Action of Explosives," delivered at the Institution of Civil Engineers, that the potential energy of all powders was very nearly the same; a view recently indorsed by Sir W. Armstrong, who stated that rather more of the slowest-burning powder was required to produce a given ballistic effect. We venture to say that, had the questions in review been under the control of a single, competent, fully-responsible man, the anomalies which we have pointed out could never have arisen, the aid of practical mathematicians would have been invoked, and the warnings of Sir W. Armstrong and others would not have been disregarded.

The public, no doubt, is weary of the constant discussion of past blunders, and the repeated allusions to them would be unjustifiable were it not for the vital bearing which these have on the future, and a most valuable result will be obtained if our efforts, and those of other writers, should be the means of destroying our absurd system of administration altogether, or at any rate of dispelling the fatal complacency in which the Ordnance Department wraps itself, and which found a voice when Colonel Maitland declared two years ago "that our ballistic knowledge has long been fuller and more complete than that of any of the Continental authorities"!

But it is proverbially easy to find fault, especially with Government departments, though by no means so easy to propose practical remedies for defects of administration which force themselves so irresistibly upon the nation as do the shortcomings of our naval and military management. Fortunately, however, no great originality is required on the part of the would-be reformer. He has only to observe how great private firms manage their business, and carry on operations quite as extensive and complicated as any of the branches of Her Majesty's service. What private firm could exist, secure the confidence of its customers, or the soundness of its work, if its head were appointed for five years, and selected, not because he had received special training in the business which he is about to manage, but had done good service in some other situation for which he had been trained; or, worse still, if the selection were made because the man selected was a good fellow and on the best of terms with all the members of the firm! Has any great firm ever started as a company? Has not every one of them owed its origin to the personal qualities of some one man, and those that have survived the death of their founder, have been carried on by men of distinguished ability selected usually by him. We do not speak of enterprises requiring so little originality as railway, gas, or water companies, but even in them the chairman rises by a species of natural selection to a position of prominence, the natural homage due to a master mind. Would any sane man propose, for a moment, that the chairmen of such companies should be changed every five years, and farther, that in order that they might suffer no loss they should exchange offices, that is, the railway chairman, at the expiration of his term, should become chairman of the gas or water company, and so on?

Yet this is precisely the way in which our dockyards and arsenals are managed. Officers, most of them most estimable and excellent gentlemen, who happen to be in favour with the superior powers, receive these desirable appointments, and often travel from one to another till they are obliged to retire from the service altogether. They would be more than human if they refused the offers made to them, and it is unreasonable for the public to cover them with abuse on account of shortcomings which are due to the system, and not to the individuals. We cannot, for a moment, admit that any of the committees are corrupt in the slightest degree, directly or indirectly, or that they have not done their best to carry out the work intrusted to them; neither are we disappointed with the results of our absurd organisation, any more than we should be with the misfits which would result if we insisted on our tailor becoming our bootmaker also.

Take the case of the Ordnance Committee. It is composed of officers who, including the President, are being continually changed, and it also numbers two apparently permanent civil members. Not one of these gentlemen has been brought up to the business of steel-making or gun manufacture, not one of them has made himself a name in the branch of manufacture and metallurgy which the Committee directs, not one of them would be competent to go abroad and start a steel-works and gun factory unaided by the contractors and subordinate experts about them—how can they be competent to deal either with the complicated theories or the practical details of gun manufacture? and when failure occurs, who is to blame?

Judging by Colonel Maitland's lecture and Sir F. Bramwell's expositions, the Committee, as a body, and as individuals, are not only satisfied but even complacent, for they find that other nations are in almost as bad a muddle as we are ourselves. It is perfectly obvious that there must be individual responsibility. The head of each department must be a permanent officer directly responsible for the design and execution of such things as the military or naval forces require, and these heads should be selected from the most able men to be found within or outside the services, men who have already achieved a reputation in the special departments for which they are required.

And there are precedents for this. The Post Office;—can anything exceed the admirable manner in which that branch of administration works, and keeps in the forefront of progress? It is needless to say that it is not worked by shifting committees. Or, take the steam department of the Admiralty. We never hear of serious complaints of the main engines or the countless subordinate machines of our war-ships; our Navy is ahead of all others in respect of adapting every useful invention, every scientific appliance; but then Mr. Wright is a permanent chief, and he is not hampered by a committee composed, shall we say, of carpenters appointed for short terms of office. And yet the changes wrought in Mr. Wright's department during his long term of office are more extensive in kind and much more varied in detail than anything the Ordnance Department have had to contend with. The steam-engine has been completely altered, surface condensation has been introduced, the steam-pressure has been increased eight-fold, compound and triple expansion has been introduced, the whole system of torpedo warfare has come into being with all its complicated appliances, the electric light has been adopted, and in addition the design and supervision of the Dockyard machinery has fallen to his share. The public never hears of Mr. Wright: had we not mentioned his name, most of our readers would have been ignorant as to who was the meritorious officer to whom we were referring; his very virtues have been the cause of his obscurity; his is not an heroic part, and he has never drawn public attention to himself by making a mess of anything.

And next, let us look abroad. We have no hesitation in stating that the most successful gun factory in the world are the Abouchoff Works near St. Petersburg. That establishment, since 1866, has been under the direct personal control of Admiral Kolokolzoff, and during that period the guns turned out have not varied either in design or material; they have been increased in length and constructed to produce higher muzzle energy; but it is an absolute fact that the projectiles which fit the guns of 1866 can be fired from the guns of to-day, and *vice versâ*. None of the Abouchoff guns have ever burst or injured a single man! The Committee on the *Collingwood* accident ascribe the disaster in part to the unequal composition of the material. Admiral Kolokolzoff provides against the possibility of this by using nothing but crucible steel. His casting-house contains about 2000 crucibles; each holds a small charge of steel, the composition of which is determined with the utmost care and exactness. The consequence is that his material is absolutely uniform, and, in addition, he is the only man that has adopted Whitworth's method of fluid compression. He does not use crucible steel because he has no other means of casting: he has Bessemer converters and Siemens-Martin furnaces; but for the highest-class work he prefers the crucible metal, because of its necessary uniformity when prepared with proper care. Had we had a man of the Admiral's capacity permanently at the head of our Gun Factory, had we subsidised any important steel-works as liberally as the Elswick firm has been assisted, we could also, twenty years ago, have had ingots of 40 tons weight of crucible steel of any quality desired. The Abouchoff works began to make 12-inch guns about the same time as we did, but their gun of the same proportions as those of the *Collingwood* weighs 50½ tons against the 43 tons of our discredited weapon. Our amended guns will weigh the same as the Russian. How is this to be accounted for, if we be, as Colonel Maitland asserts, far ahead of our neighbours in the science of gunnery?

Let us now contrast the Russian record with the history of our own guns. Sir William Armstrong introduced what he, in his address to his shareholders, calls, with some pride, his own gun—our first breech-loader. It was a built-up gun, upon the principles advocated by Mr. Mallet in his work on artillery in 1856, and the breech mechanism was a close imitation of that of the guns on board the Chinese junk which was moored off Essex Street during the Exhibition of 1851. At that time the Broadwell ring, or, rather, gas-check, such as we know it applied to muzzle-loaders, had been used at Woolwich, but had probably been forgotten; at least it was not applied to the Armstrong breech mechanism, which failed from its avowed danger when applied to the larger calibres of guns. We then gave up breech-loading and reverted to muzzle-loading, and finally we have come back to breech-loading, and adopted steel some twenty-five years after the Russians had completely solved whatever difficulties there may have been in the process of using it. In muzzle-loaders we revert to the gas-check, and so we have at least three classes of projectiles in use instead of one only. How is it that we have got into all this confusion? The only possible answer is that it is caused by our absurd system of having no permanent responsible scientifically educated officer at the head of each department of the Arsenal. The newly appointed chief knows nothing of what his predecessor did or what his experiences had been, for experience cannot be readily communicated from one man to another; he is, in fact, not a chief, but, for more than half his time, the slave of his permanent subordinates.

HAINAN AND ITS PEOPLE

Ling-Nam, or Interior Views of Southern China, including Explorations in the hitherto untraversed Island of Hainan. By B. C. Henry, A.M. (London: S. W. Partridge and Co., 1886.)

PORTIONS of this book have already appeared from time to time in the two magazines in the English language published in China, the *China Review* and the *Chinese Recorder*, but they well deserved the more permanent book form, for the author, like many other missionaries, has travelled widely in parts of China which are rarely visited by Europeans. Mr. Henry, too, writes from a full mind; he has made the most of his great opportunities, and accordingly he has contributed here a very real and solid addition to our knowledge of the Middle Kingdom. In reading it we are constantly reminded of a work written a good many years ago by another missionary, which has now almost attained the dignity of a classic, viz. Dr. Williamson's "Journeys in North China"; both are of the same useful, substantial kind, and for a long time to come both will have to be referred to for information in regard to the respective districts with which they deal. Mr. Henry refers solely to Southern China, as the name *Ling-Nam* ("South of the Ridge") implies, and to the Kwangtung or Canton province. He describes various journeys through the central and northern parts of this large and populous province, along the principal streams. As we read of town after town with populations of 100,000 and over, we begin to understand how populous China is. But then, with the exception of the valley of the Yangtsze, the two great southern provinces of Kwangtung and Kwangsi are the most thickly peopled of the whole empire. Even those who have travelled in parts of the Canton province will be surprised to learn from Mr. Henry of the magnificent scenery of the north and north-west. The idea of the passing traveller in and around Canton and the neighbouring cities is that the whole province is a vast plain in a high state of cultivation; but in the upper courses of the tributaries of the West River Mr. Henry found scenes worthy of the wildest mountain regions. Here also, on the borders of Hunan, he came in contact with one of those tribes which are found like scattered fragments over the whole of China south of the Yangtsze—amongst, but not of, the Chinese, with their own communities living generally in fastnesses amongst the mountains, preserving in a great measure their ancient habits, and but slightly contaminated by the proximity of their Chinese conquerors. Their name is legion, and they are sure to furnish abundance of work for ethnologists in the future. In the present instance the people are called the Iu, and are described by Mr. Henry as lower in stature than the Chinese, with a similar complexion, although some are almost copper-coloured. They do not shave the head, but wear the hair coiled up behind, men and women having long hair. They wear immense silver earrings and necklets, while the hair is decorated with ornaments made of the pith of the wood-oil tree and cocks' feathers. Their territory is forbidden ground to the European, the Chinese taking care that the restriction is rigorously enforced. The meagre Chinese accounts of this people